

REMARKS

Applicant's claims are directed to an antimicrobial nonwoven web having odor absorption properties. Independent Claims 1, 13 and 23 require the nonwoven web to include a plurality of nonwoven fibers, and about 0.1-10% by weight of a halogenated polystyrene hydantoin including a plurality of repeating units and halogen atoms chemically linked to the repeating units. Each of the repeating units includes an amide nitrogen and an imide nitrogen. At least about 90% by weight of the halogen atoms are chemically linked to the amide nitrogen atoms. Claim 1 is further amended to indicate that about 75-100% of the amide nitrogen atoms are chemically linked to halogen atoms.

In contrast to previously known halogenated polystyrene hydantoins, the hydantoin used by Applicant is stable in that substantially no halogen is released over time. This is shown by Applicant's examples. Conventional wisdom has involved the use of hydantoins containing the maximum number (2) of halogen atoms for maximum odor absorption properties. In each repeating unit, halogen atoms were linked to both the amide and imide nitrogen atoms. Because the halogen atoms linked to the imide nitrogen atoms were relatively unstable, free halogen was released during use (See Example 1). This resulted in skin rash and other undesirable effects. By cutting the number of halogens roughly in half, with the remaining halogen atoms linked essentially to the amide nitrogen atoms, Applicant has provided an antimicrobial nonwoven web having substantially no release of halogen (See Examples 2-8).

Applicant's independent claims require at least about 90% by weight of the halogen atoms to be chemically linked to the amide nitrogen atoms. This inherently means that at least about 89% by weight of the halogenated polystyrene hydantoin is mono-halogenated, with halogen atoms linked to the amide nitrogen atoms. For instance, if 10% by weight of the halogen atoms are linked to imide nitrogen atoms and the remaining 90% are linked to amide nitrogen atoms, then at least 88.9% of the hydantoin repeating units would be mono-halogenated (on the amide nitrogen atoms) and up to 11.1% of the hydantoin repeating units would be dihalogenated.

Dependent Claims 2 and 16 require at least about 95% of the halogen atoms to be chemically linked to amide nitrogen atoms. This inherently means that at least 94.7% by weight of the hydantoin repeating units are mono-halogenated (on the amide nitrogen atoms) and up to 5.3% by weight of the hydantoin repeating units are di-halogenated.

Dependent Claims 3 and 17 require at least about 99% by weight of the halogen atoms to be chemically linked to amide nitrogen atoms. Dependent Claims 4 and 18 require about 100% by weight of the halogen atoms to be chemically linked to amide nitrogen atoms.

Claim Rejections Based On 35 U.S.C. §103(a)

The Examiner rejected Claims 1-31 under 35 U.S.C. §103(a) as obvious over U.S. Patent 6,548,054 to Worley et al. in view of U.S. Patent 4,842,593 to Jordan. The Examiner rejected Claims 32-37 under 35 U.S.C. §103(a) as obvious over Worley et al. in view of Jordan et al. and U.S. Patent 6,183,763 to Beerse et al. These rejections are respectfully traversed.

a) Worley et al. Does Not Disclose Or Suggest The Claimed Halogenated Polystyrene Hydantoin

The Examiner relies on a chemical formula, described at column 4, lines 34-55 of Worley et al. The chemical formula discloses a single repeating unit of a halogenated polystyrene hydantoin having both amide and imide nitrogen atoms. Each of the amide and imide nitrogen atoms may be independently linked to a chlorine, bromine or hydrogen atom provided that at least one nitrogen atom is chemically linked to a chlorine or bromine atom. There is no disclosure of a percentage of halogen atoms being linked only to amide nitrogen atoms.

The passage (col. 2, lines 53-55) indicating that each of the nitrogen atoms is independently linked to chlorine, bromine or hydrogen means that different repeating units may have different configurations. A polystyrene hydantoin molecule (like most polymer molecules) contains a large number of repeating units. Within a molecule, some of the

repeating units may have halogen atoms linked to both the amide and imide nitrogen atoms. Other repeating units may have halogen atoms linked to only one nitrogen atom or the other. There is no disclosure of a halogenated polystyrene hydantoin molecule in which at least about 90% of the halogen atoms are linked to amide nitrogen atoms. As explained above, this would require that about 89% or more of the repeating units are a) monohalogenated, with b) halogen atoms linked only to the amide nitrogen atoms. While it is possible that such a molecule could occur at random in a mixture containing a large number of halogenated polystyrene hydantoin molecules, the statistical likelihood is remotely small.

Even if such a molecule were to occur at random, in a mixture, Applicant's independent claims would not be satisfied. The independent claims require a nonwoven web including about 0.1-10% by weight (of the nonwoven web) of a halogenated polystyrene hydantoin having the claimed properties. To meet this limitation, a large collection of molecules having the claimed properties would be required. Again, the chemical formula in Worley et al. discloses a) a single repeating unit of a halogenated polystyrene molecule which may have b) halogen atoms linked to both amide and imide nitrogen atoms, or c) a halogen atom linked only to an amide nitrogen, or d) a halogen atom linked only to an imide nitrogen atom. As explained above, the likelihood of finding one halogenated polystyrene hydantoin molecule having the claimed properties in a statistical mixture of molecules satisfying the formula of Worley et al., is remotely small. The statistical likelihood of finding a large collection of halogenated polystyrene molecules having the claimed properties is substantially smaller, and is infinitesimally small.

In summary, the chemical formula in Worley et al. does not require any amount of polystyrene hydantoin repeating units to have halogen atoms attached only to amide nitrogen atoms, does not require any number of different repeating units within a molecule to have the same structure, and does not require different molecules in a collection to have the same or similar structures. Such a chemical formula does not anticipate or render obvious a halogenated polystyrene hydantoin constituting about 0.1-10% by weight of a nonwoven web, wherein at least about 90% of the halogen atoms (in the entire collection of molecules) are chemically linked to the amide nitrogen atoms.

b) Even If Worley et al. Disclosed The Structure Of Claimed Halogenated Polystyrene Hydantoin, The Disclosure Would Not Be Enabling

Even if Worley et al. disclosed the structure of the claimed halogenated polystyrene hydantoin, the reference would be inoperable and nonenabling. See, M.P.E.P. 2121.02. One of ordinary skill in the art must be able to make or synthesize the claimed compound in order for a reference disclosing its structure to be operable against Applicant's claims.

When a prior art reference merely discloses the structure of a claimed compound, evidence showing that attempts to prepare that compound before the date of invention were unsuccessful will establish inoperability. In Re Wiggins, 179 USPQ 421 (CCPA 1971). In this instance, Worley et al apparently tried to make a substantially monohalogenated polystyrene hydantoin composition, but was unsuccessful in making a composition satisfying the Applicant's claim limitations.

Worley et al discloses a reaction process in which the percent halogen on the polymer can be controlled by adjusting pH. At a pH of 6-7, maximum halogenation is achieved (implying production of a dihalogenated compound). At a pH of 12, the reaction prefers monohalogenation. At a pH of 7-11, mixtures of dihalogenated and monohalogenated compounds are obtained (Col. 7, lines 5-9).

However, the Examples of Worley et al. illustrate a failure to prepare a substantially monohalogenated polystyrene hydantoin at any pH, wherein at least about 90% of the halogen atoms are attached to amide nitrogens and/or about 75-100% of the nitrogen atoms are attached to halogens, as required by Applicant's claims.

Example 4 of Worley et al. is directed to controlling chlorine loading on polystyrene hydantoin beads, by adjusting the amount of halogen added and/or the pH. A first preparation method, using gaseous chlorine, resulted in very high chlorine loading, with chlorine atoms bonded to both amide and imide nitrogen atoms (Col. 10, lines 5-12). A second preparation method using halogen solutions having pH's of 8.8 and 8.0 resulted in mixtures of dichloro and monochloro polystyrene hydantoins (Col. 10, lines 13-33). A third

method, performed at a solution pH of 6.5, yielded primarily the dichloro polystyrene hydantoin derivative (Col. 10, lines 33-65).

Two experiments were directed at achieving lower overall chlorine levels of about 10% by weight. A first preparation method, performed by washing hydantoin beads with higher chlorine loadings using a basic solution, yielded a polystyrene hydantoin “containing primarily the monochloro sodium salt, but some of the dichloro derivative” (Col. 10, line 66 – Col. 11, line 10). A second procedure, involving preparation using a very high solution pH of 12.5, yielded a polystyrene hydantoin “containing primarily the monochloro sodium salt, but some of the dichloro derivative as in the first procedure” (Col. 11, lines 10-21). Neither experiment disclosed a halogenated polystyrene hydantoin wherein at least about 90% of the halogen atoms were linked to the amide nitrogens as required by Claims 1, 13 and 23. Neither experiment disclosed a halogenated polystyrene hydantoin wherein at least about 95% of the halogen atoms were linked to amide nitrogen atoms (Claims 2 and 16), or at least about 99% of the halogen atoms were so linked (Claims 3 and 17), or about 100% of the halogen atoms were so linked (Claims 4 and 18).

A subsequent experiment in which the supply of chlorine was reduced, may have resulted in a substantially monochlorinated polystyrene hydantoin (Col. 11, lines 26-43). However, this polystyrene hydantoin had only a 6.8% by weight chlorine loading. As explained below, a monochlorinated version in which at least 75% of the amide nitrogen atoms are chlorinated, would require an overall chlorine loading of at least 12.1% by weight. Thus, Worley et al. did not produce a product in which at least about 90% by weight of the halogen atoms are chemically linked to the amide nitrogen atoms and/or about 75-100% of the amide nitrogen atoms are chemically linked to halogen atoms as required by Applicant’s claims.

A precise calculation of a level of chlorine loading needed to satisfy Applicant’s claims can be derived from the chemical formula. The experiments in Example 4 of Worley et al. were performed using poly-5-methyl-(4' vinylphenyl) hydantoin beads (Col. 9, lines 65-67). This corresponds to the chemical formula (Col. 2, lines 34-56) wherein R' is hydrogen. The starting molecular weight of the repeating unit (prior to

halogenation) is 216. The molecular weight of chlorine is 35. If only the amide nitrogen is halogenated (displacing a single hydrogen atom), then the chlorine loading for the repeating unit would be $35/216$, which is 16.2%.

Thus, if 100% of the amide nitrogen atoms and none of the imide nitrogen atoms in the polystyrene hydantoin were chlorinated, the chlorine loading would be 16.2% by weight. If 11% of the imide nitrogens were also chlorinated (the maximum permitted by Applicant's claims), then the chlorine loading would be 17.8% by weight. If only 75% of the amide nitrogen atoms were chlorinated, the chlorine loading would be at least 12.1% by weight (which is 75% of 16.2%), or slightly higher if some of the imide nitrogens were also chlorinated.

Thus, using poly-5-methyl-(4' vinylphenyl) hydantoin as the starting material, the limitations of Applicant's claims can only be satisfied if the ultimate chlorine loading is at least 12.1% by weight. The experiments in Worley et al. which produced "primarily the monochloro sodium salt, but some of the dichloro derivative" had chlorine loadings of only 10.3% to 10.8% by weight (Col. 11, lines 5-10 and 17-24). The only experiment which may have yielded a substantially monochloro product had a chlorine loading of only 6.8% by weight (Col. 11, lines 34-41). Worley et al. was not able to produce a halogenated polystyrene hydantoin composition (collection of molecules) in which at least about 90% of the halogen atoms were linked to amide nitrogen atoms and/or about 75-100% of the amide nitrogen atoms were chemically linked to halogen atoms.

c) The Combined References Do Not Render The Claims Obvious

The secondary references to Jordan et al. and Beerse et al. do not fill the gaps in the Worley et al. disclosure. Neither secondary reference, alone or combined with Worley et al., teaches an antimicrobial nonwoven web containing about 0.1-10% by weight of halogenated polystyrene hydantoin in which at least about 90% of the halogen atoms are linked to amide nitrogen atoms and/or about 75-100% of the amide nitrogen atoms are linked to halogen atoms. Furthermore, while the secondary references disclose various absorbent articles and wipes which may be treated with odor control agents, the references do not

address or recognize the problem of free chlorine release resulting from the use of chlorinated odor control agents. The references are concerned with the treatment of aqueous liquid insults using odor control agents and the like, and are not concerned with side effects resulting from use of the odor control agents. Accordingly, there is no suggestion in the art to modify the combined teachings of the primary and secondary references to arrive at Applicant's antimicrobial nonwoven web, which substantially reduces the release of chlorine from the odor control agent.

d) Worley Et Al. Is Not Available As Prior Art

Enclosed herewith is a Declaration Of Roger B. Quincy, III Pursuant To 37 C.F.R. §1.131(a). As explained in the Declaration, Mr. Quincy made the claimed invention before the 06 September 2001 filing date of Worley et al. Accordingly, Worley et al. is not available as prior art, and should not bar the grant of a patent to Mr. Quincy.

e) Conclusion

Applicant believes the claims, as now presented, are in condition for allowance. If the Examiner feels that any issues remain unresolved, then Applicant's attorney would appreciate an opportunity to discuss them by telephone.

Respectfully submitted,



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